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THE MEANING OF $\sqrt{-1}$

THE following discussion is an attempt to suggest something by way of interpretation of the square root of a negative quantity. It is, however, not the discussion of a mathematician. but, as will doubtless appear all too soon, of a layman in mathematics, who here and now makes apology to the mathematicians for presuming, unrobed and untrained, to stand in their pulpit. The layman must at times think and speak for himself, and though he may express only platitudes in a way as fantastic and unconventional as it is limited in point of view, his thinking and speaking are always of value to himself and are not always without some interest to others.

In general the contention here is that in the square root of a negative quantity there is—*except for an important qualification to be made hereafter*—only an application of the negative to the sphere or field of products or areas, that is, to a two-dimensional space, just as in the negative quantity, -1, there is such an application in the sphere of mere serial or linear composition or aggregation or, geometrically, of a one-dimensional space. So viewed, the imaginary quantity is essentially no more imaginary than the ordinary minus or negative quantity, although naturally the difference of the field produces different results and renders the quantity itself, $\sqrt{-1}$, useful in different ways.

The discussion proposed is best introduced by a simple problem whose solution will be seen at once to involve imaginary quantities. Thus, given a straight line, $2m$, the problem is to divide this into two parts so that the product of the parts will exceed m^2 by an amount n; and the solution is as follows: Let x be one of the parts. Then $2m - x$ is the other; $2mx - x^2 = m^2 + n$; and $x = m - \sqrt{-n}$, while the remaining part is $m + \sqrt{-n}$. In other words, as will hereafter be emphasized frequently, the excess of n over m^2, the product of the line's halves, takes the value of x, as well as that of $2m - x$, into the sphere of negative quantity, *but of negative quantity, not as length, but as the root or side of a negative area.* Were there no excess, were the desired product equal to, or less than,

m^2, the necessary parts would be quite without such complication.

Plainly, too, with regard to the values $m - \sqrt{-n}$ and $m + \sqrt{-n}$, no other result should be expected; for, in the first place, the equation $2mx - x^2 = m^2 + n$ is distinctly an equation of products or areas; in the second place, the problem, though dealing with a line, or a merely serial aggregate, distinctly asks for parts that are not just component lengths or parts, but sides of an area or factors of a product; and, in the third place, m^2 being the maximum or limiting product or area in the group of what may be called the normal or positive results of divisions of the aggregate or line, any product or area required to be in excess of m^2, if truly meeting the conditions of the problem, must encroach upon a field of minus areas. Similarly, in a purely linear field a line of length l could be so divided that one of its parts would exceed the line by s, but only if encroachment upon a field of negative lengths be allowed, the required parts being $l + s$ and $-s$.

That minus areas, or products, can have only dimensions, or factors, whose unit is $\sqrt{-1}$ is self-evident. Whence the meaning of this unit, or at least an important idea introductory to the meaning, must be, as asserted, that it represents nothing more nor less than an application of the negative to a two-dimensional field. In the solution of the given problem, however, the parts, sides or factors which were found, namely, $m - \sqrt{-n}$ and $m + \sqrt{-n}$, were only partially imaginary, and this only partial encroachment upon the field of negative areas seems to call for some explanation, although in the case of the line l, divided so that one part should exceed its length, the result was also a mixed one, the parts being $l + s$, or $l - (-s)$, and $-s$, or $l - (l + s)$, *and although also logically an unmixed negative is quite beyond what is thinkable.*

In explanation, then, of those mixed quantities $m + \sqrt{-n}$ and $m - \sqrt{-n}$, I venture simply to say that they are both mixed because they are both the sides or factors of a mixed area, or product, which is mixed for just the reason, already given, that m^2 is a maximum among all the possible wholly positive values resulting from division of $2m$. Surely, m^2 being a maximum, $m^2 + n$ can have no other meaning except that of the mixed area $m^2 - (-n)$, with the obvious factors $m + \sqrt{-n}$ and $m - \sqrt{-n}$; exactly as with the line l, where, l being the maximum, the part $l + s$ could have no other meaning save that of $l - (-s)$, and the part $-s$ no other meaning save that of $l - (l + s)$.

But now, with so much clear, it will greatly assist the present undertaking to broaden the view, for obviously the cases of division where the area, or product, exceeds m^2 are only terms in a series that will include not only these, but also such as are less than m^2 or as

are greater than $2m^2$, and so on. Most generally, therefore, the terms in such a series may be put in the form $m^2 - (m - x)^2$, where $(m - x)^2$ expresses the difference between the maximum m^2 and the product, or area, that constitutes the term, and giving x definite values, the series runs: $m^2 - (m - 1)^2$, $m^2 - (m - 2)^2$, $m^2 - (m - 3)^2$, $\cdots$. But, so soon as x is larger than m, $(m - x)^2$ gets the value of $-n$,[1] and the terms will have the form, already recognized, of $m^2 - (-n)$, that is, $m^2 + n$, or, in definite values, $m^2 + 1$, $m^2 + 2$, $m^2 + 3$, $m^2 + 4$, $\cdots$. Furthermore, when n becomes equal to m^2, the subsequent terms will be $2m^2 + 1$, $2m^2 + 2$, $\cdots$. Yet, as to these last, it must be remembered that they also can have meaning only when understood as $m^2 - (-m^2 - 1)$, $m^2 - (-m^2 - 2)$ $\cdots$. And, not to go farther with this description of the series, it must be remembered also that *all the terms represent products or areas;* and it will be readily observed that as a whole the series is one of certain crises, or at least that the terms as formally represented suggest certain crises. When, for example, x becomes larger than m, the factors x and $2m - x$ at once become in part imaginary quantities, $m - \sqrt{-1}$ and $m + \sqrt{-1}$, $m + \sqrt{-2}$ and $m - \sqrt{-2}$, and so on; and, when n becomes equal to m^2, the term $m^2 - (-n)$, which *as in the series* will be $2m^2$, will have the *actual* value of zero, its factors being $m - m\sqrt{-1}$, and $m + m\sqrt{-1}$,— values which, as I understand them, indicate that m^2 has been taken twice, but in such a way that one m^2 belongs to the positive field, the other to the negative. Similarly in the case of the parts of the line l, if the excess of one part over the whole line were to be l, the excessive part *as a part* would be $2l$, or $l - (-l)$, and while, to repeat, such is in truth its length *as just such a part of the line,* its own independent value is zero, for it is itself composed of the two parts, $-l$ and $+l$. A diagram may be quite unnecessary, yet will do no harm. Thus, in Fig. 1, let AB be the line of length l, and S^1, S^2, S^3 be various dividing points, but S^1 the point by which one part is made to exceed the whole line by its length l. Then S^1B *as a*

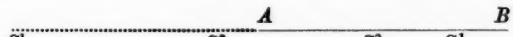

FIG. 1.

part of the line is $2l$, the other part, S^1A, of course being $-l$, but *in itself,* that is, as itself a whole or a sum, S^1B is equal to zero. And in like manner, with apology for so much repetition, when n becomes equal to m^2, the resulting term is variously $2m^2$, $m^2 - (-m^2)$, and O.

[1] With x larger than m, $(m - x)^2$ *quite by itself* would be $(-1)^2$, $(-2)^2$, $\cdots$, equal to $+1$, $+4$, $\cdots$, but *in the series under examination* these areas are made negative and the terms in which they belong, instead of being $m^2 - 1$, $m^2 - 2$, $\cdots$ are, as given, $m^2 + 1$, $m^2 + 2$, $\cdots$ or, again, $m^2 - (-1)$, $m^2 - (-2)$, $\cdots$.

The series, then, of the products, or rectangles, has these two crises; first, when $x < m$, and second, when $n = m^2$. There may be other crises, but another consideration now seems more urgent. The critical term, just shown to be equal to zero, is of course a product; it is a product with dimensions $m + m\sqrt{-1}$ and $m - m\sqrt{-1}$; and although a zero product, or area, having such factors may seem at first thought absurd, yet second thought will make it richly significant. At the very beginning of the series was there not also a product, or rectangle, equal to zero, but with dimensions $m + m$ and $m - m$? This initial term, it is true, could have only the area of the line $2m$, which though $2m$ in length would be zero in *actual* area, but such an area as this, though equal to zero, had a real meaning so soon as the problem, declaring the parts of the line to be factors of a product or sides of an area, was merely stated.[2] *The statement ipso facto transformed the mere line into a sphere of potential area, and the potentiality was actually in the zero whose factors,* or *dimensions, were* $m + m$ *and* $m - m$.[3] And the two rectangles, the two zero products or zero areas—what of them? What, in particular, of the peculiar difference between their factors, one having the factors $m + m\sqrt{-1}$ and $m - m\sqrt{-1}$, and the other, $m + m$ and $m - m$? The zero area of the imaginary factors, or dimensions, must also, as is plain, be a straight line of length $2m$, but can it be, following the suggestion of the symbols, that this line makes a right angle with the other? That in the series from one of these zeros to the other there is, geometrically described, a rotation, or at least, whatever be the intermediate transformation, a *virtual* rotation of the original line through 90°? That the zero area of the imaginary factors is not *a* second dimension, but a realization of *the* second dimension of the other zero area?

The questions are certainly important and they seem to call for an unequivocal answer in the affirmative. Lest, however, the suggestion of the symbols be not sufficiently clear, the following somewhat detailed geometrical demonstration is also given; and given only the more confidently since, besides representing the rotation,

[2] The dimensions of the two zero areas, if written with full regard to their character or quality as not just flat quantities, but as dimensions, would be, in the first case, $m\sqrt{+1} + m\sqrt{-1}$ and $m\sqrt{+1} - m\sqrt{-1}$ and, in the second case, $m\sqrt{+1} + m\sqrt{+1}$ and $m\sqrt{+1} - m\sqrt{+1}$ or $2m\sqrt{+1}$ and $0\sqrt{+1}$.

[3] Or even this may be said: The zero area of a line has meaning in just so far as the line's division implies some functional relation, such as that of the sides of a rectangle, between the resulting parts or, arithmetically, as its recognized composition implies multiplication, that is, the treatment of the parts, not merely as component parts, but also as factors. Just such an implication makes the line an area *potentially;* nor is such potentiality only a polite name for unreality.

so-called, the various figures will also serve to clarify what has been said of the nature and order of the terms of the series, of the crises that characterize the series, and especially of the necessary encroachment of the series on a field of minus areas or products.

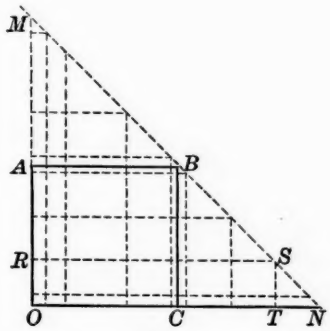

FIG. 2.

Thus, in each of the accompanying figures, *ORST* represents some term in the series. Fig. 2 gives an indefinite number of terms, or rectangles, and shows how a rectangle, as it were, emerges out of the line *ON*, *ON* being equal to $2m$; gradually moves, in sides and area, towards *OABC*, which is m^2; becomes equal to, and identical with, *OABC*; and eventually, leaving *OABC*, loses itself in the line *OM* perpendicular to *ON* and also equal in length to it. In this figure, too, as also in the other figures, *TN* and *OT* are x and $2m - x$, respectively. In Figs. 3–8 the square *HIJB*, representing the difference between m^2 and $2mm - x^2$, that is, between the *actual* maximum and the general term of the series, first, in Fig. 5 is seen, after a gradation from an equivalence with this maximum, to have become zero; secondly, in Fig. 6 and thereafter, *having passed through zero,* to be a minus area; and, thirdly, in Fig. 8, to be again equivalent to, or identical with, *OABC*, the maximum. And in Figs. 6 and 7, indeed also in Fig. 8, the dimensions of the general term *ORST*, always including as these do the side or root of the minus area *HIJB*, must be in part "imaginary." *RS* and *ST*, I say, must be "imaginary" lines; they are imaginary to just the extent of their including, the one positively and the other negatively, the lines *HI* and *IJ*, since either *HI* or *IJ* is equal to $\sqrt{-HIJB}$;[4]

[4] So do we see how a line as just a line and a line as in a given relation, as the side of an area, for example, and of an area, too, that is itself in a given relation to other areas, are of different values. As just a line *HI* is just *HI*, having some given length. As just a side of the square *HIJB*, it is indeed not merely *HI*, but still merely $\sqrt{HIJB}$. As the side, however, of *HIJB in the figures* 6–8, representing a portion of the series now in mind, it is $\sqrt{-HIJB}$.

and, again, they are "imaginary," although when capable of such simple geometrical demonstration they lose much of their supposedly imaginary character.

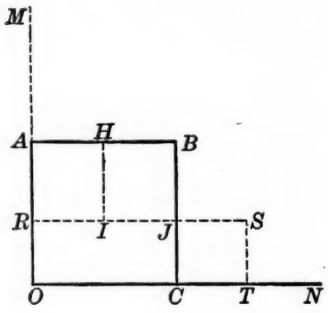

FIG. 3.

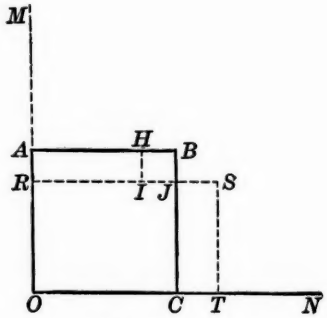

FIG. 4.

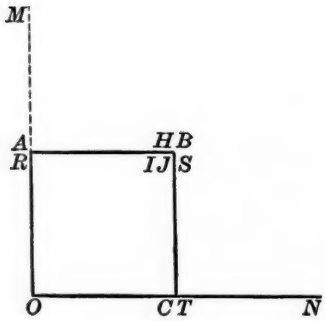

FIG. 5.

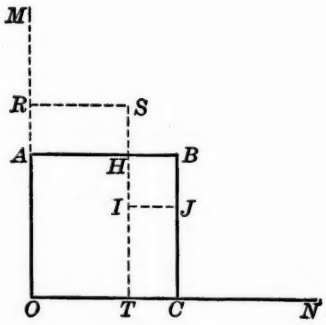

FIG. 6.

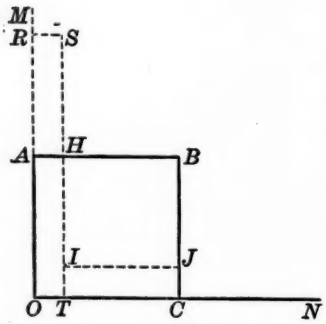

FIG. 7.

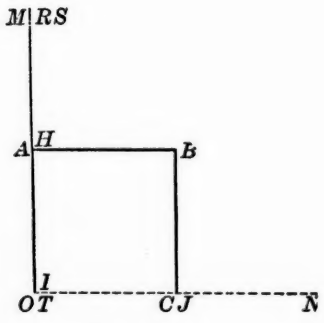

FIG. 8.

And so, though with regard to but one simple, specific case, I would suggest what is, or what may be, the meaning of $\sqrt{-1}$. Certainly it seems, on the evidence before us, that, if meanings have parts, at least in part $\sqrt{-1}$ means the application of the negative,

or, more specifically, of the idea of the negative quantity, to the sphere or field of products or areas, and, as will be recalled, this is the notion of it, subject to a promised qualification, asserted at the very beginning of the present discussion. Yet, before the important qualification is made, there are several minor suggestions, more or less closely connected with what has been said, to which brief attention is asked.

1. Not, indeed, the actual or static or positive value of *OM* or of the product whose factors are $m + m\sqrt{-1}$ and $m - m\sqrt{-1}$, but the *realized* value, the value *as at a certain point in the series,* is $2m^2$, and $2m^2$, it is to be specially observed, *is equal to the total field or area of the series from ON to OM.*

2. The rectangle *ORST* as required to be greater than the maximum square *OABC,* not only is what gives rise to the imaginary quantity, but also, being statically or constructively impossible, calls for just such a generated area as is so conspicuously evident in the term *OM* or product $2m^2$ and as also in less degree is to be seen in every other term of the series. Such generation of area is, of course, closely connected with the meaning of the rotation that is effected by the series and that has been indicated already.

3. The values of x and $2m - x$, always having the forms $m - \sqrt{n}$ and $m + \sqrt{n}$ or $m - \sqrt{-n}$ and $m + \sqrt{-n}$, are such as to suggest a straight line, the equation for which, *MO* and *ON* being the coordinates, would be $x + y = 2m$. This equation, however, would only hide the relation of the line to the series. This line is *MN* (Fig. 2), which is (1) the path of the dividing point *S,* whose divisions on *MN* are proportional to those of *T* on *ON,* and (2), as the path of such proportional divisions and *as a diagonal,* a projection of the line *ON* on the peculiar plane or two-dimensional field of the series. *MN,* in fact, when regarded in the light of its place in the series, or in the geometrical representation of the series, is what I should like to call a two-dimensional line and the points in its path would be two-dimensional points or area-points, some of them, as in the part *MB,* being points partly in the negative and partly in the positive field or being points in what above was styled a mixed area—all of which, perhaps, is inexcusably subtle, but it seems to me to be not without some point of its own! Those who still prefer the equation $x + y = 2m$, may fall back upon that!

But, finally, the promised qualification, in effect only a recognition of the limited view afforded by just one simple case, is that the notion of $\sqrt{-1}$ here asserted, like any other notion, can be only partially or relatively true. Inasmuch, however, as the relatively true is always bound to be informed with, or to have some contact with, what is really and fully true, there is always ground for gen-

eralization even from what is relative, and being a philosopher, at least by profession, I find the temptation to generalize irresistible. Perhaps, moreover, generalization is only the proper complement, at least poetically just, of qualification. Does it not quickly transform that from which it proceeds?

The notion of the product or area, so essential to the foregoing study, is certainly a wider and deeper one than its place in the distinction between a one-dimensional and a two-dimensional field, or between mere linear aggregation or addition and multiplication, would make it. Or at least this: So far as the notion of area has been used here, it is really more general, being applicable to any definite portion of an $n+1$-dimensional field relatively to an n-dimensional field. Indeed, in the constant association of areas with products, that must have been conspicuous in the earlier paragraphs of this paper, such a general view of areas was already implied. A cube, or any solid, is a product—the area of an area, and so on.

Now the particular problem examined above was a problem that to all intents and purposes was solved only by the evolution of a two-dimensional field out of a one-dimensional field, and the maximum, the static or so-called *actual* maximum in the case, representing nothing more nor less than the peculiar limitation of the one-dimensional field in a form relative to the particular problem, forced upon the process of the evolution, or rather upon the formal description of this process, the imaginary quantity. This quantity was negative because of the limiting maximum, and "imaginary" because the difference in the dimensions demanded a transcendence of the formal possibilities of the one-dimensional field. As to this transcendence, it was especially apparent at two, nay, really at three, places in the series,[5] and the part of the imaginary quantity in the realization of it was also evident. Of course, specifically, the $\sqrt{-1}$ was only the unital factor of a minus product, or area, just as the primrose is said to have been to a certain person only a primrose, but as just such a factor the $\sqrt{-1}$, or the negative area, whose sides it measured, was also a bridge, real and serviceable, between the one-dimensional and the two-dimensional fields—overcoming the limitations of the former, yet serving as a means also to the realization of the latter; and bridging those fields was the very crux of the problem.

And in the specific problem treated one thing more must be remarked, though this may be only a rewording of something already said. Associated with the imaginary quantity and plainly essential

[5] At the first term potentially already an area, though in area actually zero; at the term in which the difference between the maximum and the actual term became zero; and at the term that was $2m^2$, or $m^2-(-m^2)$, or 0.

to its meaning and value in the series, there was the idea of movement, if not also of something very like real and effective action. There was, for example, absolutely necessary to the interpretation of such a value as $2m^2$ or as that of any term in excess of m^2, the distinction between the formally actual and the realized value of the term. An important element, therefore, in the meaning of the imaginary quantity, appears to be, not merely the transition from one dimension to two, as already pointed out, or the formal transcendence of certain limitations, but something more distinctly dynamic than that. At risk of seeming only poetic, I would even say that, having terms with *realized* values so different from their formally actual values, the series seems to *do* something; it makes or achieves, or, as was said before, it generates area, not merely has or finds area.

But the notion of area is a wide one, and, now to generalize from the conditions of the particular problem, is not the essence of any real problem, mathematically put, but just the bridging of spheres of different dimensions, or say, more simply, of n dimensions and $n+1$ dimensions? Is it not the realization of area for an n-dimensional field?[6] Every n-dimensional field, however, must have its own natural maxima or minima or, more generally, its own peculiar limits, and any problem that may be formulated consistently with the structure of this field must not only encounter these limits, but also, as it is solved, must transcend them, and, mathematically, the negative quantity is often the means for the transcendence. Moreover, where there is a negative quantity there must be also an imaginary quantity of some sort and degree. In this *general* imaginary quantity, as in the $m + \sqrt{-n}$ of the problem here discussed, the relations of the n-space are seen to take their place, by a sort of projection, in the transcendent or negative sphere of the $n+1$ space. Nor is this *general* imaginary quantity necessarily a formally impossible one, like $m + \sqrt{-n}$; it is the formally impossible result of any operation, *the only condition apparently being that the operation determining the imaginary term must be the reversal of the operation by which the generation of the new sphere beyond its peculiar limits has taken place.* Thus, again, in the special case, the generated area was one of rectangles or products; the imaginary quantity was a side or root or factor.

[6] Otherwise put, the typical problem involves a functional treatment of some given field or structure, such as, for a very simple example, the even or the proportional division of a line. Functions, however, are always more general than the fields or structures within which they are applied. And so, as they are developed, they always require transcendence of the formal possibilities of these fields, that is, a change in the number of dimensions. The infinite series implies such a change or such transcendence and, as here shown, the imaginary quantity is almost an open expression of it.

The line l, too, recalled from above, affords an illustration, with which I may conclude, of the very general idea here in mind, for the notion of dimensions must also be capable of very wide generalization. Although merely as regards direction the straight line is in a one-dimensional field, yet this very thing, the direction or straightness, relatively to the *defined* length, constitutes a second dimension, the given defined length being a first dimension, and the problem of division, calling as it did for a transcendence of this first dimension, could be solved only by the use of the negative quantity, which at once involved the imaginaries, $-s$ and $l-(-s)$, that plainly were parts, not by composition or inclusion, but by the reverse operation of exclusion.

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DISCUSSION

THE PROBLEM OF OBJECTIVITY

THE task which contemporary realism regards as its special mission is to protect the objects of the physical world against the encroachments of consciousness. Anxious to avoid the error of the older realism, it has repeatedly disavowed all subjectivistic proclivities and asserted that consciousness is merely a relation among the objects and qualities which it knows. Qualities or "contents" which earlier realism regarded as purely mental are now transferred to the other side of the line and take their place alongside of the "primary qualities" as constituent members of the "objective" world.

While this spoliation of consciousness is going on, the onlooker naturally attempts to forecast the final result. So far as the data enable him to determine, there can be but one issue to the process. If the taint of subjectivism is to be completely eliminated, all contents whatsoever must be stripped away. So long as any content is left, whether it be much or little, earlier realism finds a sanction for its assumption that perceived qualities can be constituted by consciousness, and the innovations of its successor become essentially matters of detail.

If, however, we remove all contents as indicated, a situation is created which appears to involve serious difficulties. All diversity being lodged in the object, consciousness necessarily becomes qualitatively identical in all its manifestations. There can be no different forms of consciousness, but only consciousness of different objects. Having approximated the vanishing-point of abstraction, consciousness is reduced to a single dimension, that of colorless or bare awareness.

This simplicity of character renders consciousness peculiarly amenable to inference by deduction. Since awareness is absolutely transparent, so to speak, like the axioms of geometry, we are in a position to affirm that its sole relation to its object is such as its name implies, viz., that of awareness. And this deduction constitutes the basis of at least two criticisms which seem to be damaging to realism. The first is that if awareness is a detachable element in some situations, as is conceded to be the case, it must be such in all. Since the nature of awareness forbids us to say that it can ever constitute its own object—awareness of awareness being the single possible exception—we are involved in the seeming absurdity of asserting that there can be objects such as emotions without awareness. The "can be" means in this case that emotions without awareness must be regarded as a significant conception, the existence or non-existence of such emotions being a purely empirical question, like that of water on the surface of the moon. The second criticism is that we seemed compelled either to assert the same validity for all our perceptions, no matter how divergent or contradictory they may be, or to introduce anew that distinction between subjective and objective which proved destructive to the older realism.

With the merits or demerits of these criticisms we have at present no immediate concern. The sole purpose of this paper is to consider the way in which they are met by Professor Montague in his interesting article in a comparatively recent issue of this JOURNAL.[1] That realism itself has lent some plausibility to these criticisms seems to be granted by Professor Montague, but he denies that they are in any sense final. Upon closer inspection the general difficulty will be found, as he thinks, to yield to homeopathic treatment. The remedy for the difficulties incurred by realism is more realism. In order to complete the task which realism has set itself, it is not sufficient merely to transfer all the contents of consciousness to the objective world, but consciousness itself must be so transferred. The real mistake lies in the recognition that the distinction between subjective and objective is in itself and at bottom a valid distinction. And so he reaches the *ne plus ultra* of realism in the doctrine that consciousness is "a relation existing in a material nature along with other relations and, like them, describable ultimately in terms of the basic relations of space and time" (p. 377).

As a matter of convenience we may vary somewhat the order of treatment adopted by Professor Montague and take up first his view as to the general nature of what we commonly call reality. Physical objects are held to consist of energies, both inflowing and outgoing, each of these energies being correlated with some specific quality.

[1] "Contemporary Realism and the Problems of Perception," Vol. IV., p. 374.

These energies are either kinetic or potential in character. Moreover, those facts which are usually supposed to be peculiarly subjective and unique, as compared with physical reality, are likewise forms of qualified energy. "The passing of stimulus [a form of kinetic energy plus correlated specific *quale*] into sensation now appears as the production of the qualified energy of a sensation from the no less qualified energy of a nerve current." It is assumed "that when an externally observable current of kinetic energy in an afferent nerve fiber passes or seems to pass into a sensation, what really happens is the transformation of kinetic energy of motion into an equivalent potential energy of stress at the point in which the kinetic energy is redirected, viz., the move center" (p. 379).

The bearing of this view upon the first of the two general criticisms under discussion is as follows: If sensation (and ultimately the whole of consciousness) is reducible to a form of energy, all facts whatsoever necessarily group themselves upon one common level. All are forms of energy, and by consequence all are objective in precisely the same sense. "If consciousness is itself a purely objective and natural relation, the dependence of other facts upon it will not confer upon these latter any peculiar status, nor make them any less objective than if they lacked this dependence. The weight of a body depends upon the relation of that body to some other body, yet, notwithstanding such dependence, weight is as objective as inertia or figure and altogether on the same level as these seemingly more intrinsic qualities" (p. 377).

If consciousness itself is objective, then the first objection, which springs from the dependence of emotion upon awareness, unquestionably disappears. It is not evident, however, that the transference of consciousness to the category of objectivity can be accomplished so readily as might seem to be the case. According to Professor Montague, sensation is merely a certain form of qualified energy, or energy with a correlate quality. Before the sensation occurs the quality is correlated with kinetic energy. What is it that takes the place of this kinetic energy when we reach sensation? To refer the inquirer to potential energy is not to make a final disposition of him, for the reason that quality plus a form of potential energy can be regarded as equivalent to sensation only on condition that the potential energy be found identical with some element actually present in the sensation. Unless it is thus present we can not affirm that sensation *is* qualified energy. But what can we find in the sensation, besides the quality, with which the potential energy may be identified? Analysis seems able to discover but one element besides the quality, viz., our old friend, abstract awareness.

This result becomes significant the moment we inquire whether the quality revealed in sensation can exist independently of this awareness. If it can never exist independently, we are plainly on the road to Berkeleianism rather than that of panobjectivism. If, however, it can exist independently in any given case, the awareness is so far forth a detachable element. Moreover, the given case then shows conclusively that awareness is in no way constitutive of its object. This, however, is precisely the situation which was supposed to warrant the inference as to emotions without awareness, the situation which Professor Montague's specific form of realism was supposed to avoid. Whether this inference is really warranted or not, Professor Montague's argument seems, on this alternative, to impair its validity in no appreciable respect.

If we carry the argument one step farther, we find that the distinction between quality and awareness is not merely a distinction for the onlooking psychologist, but that the implications of this particular theory compel us to postulate its presence within every experience, however simple, as an element of the whole. According to Professor Montague, the "subject-object polarity so characteristic of the more advanced types of cognition" is something that gets itself made as a result of the fact that different sensations or forms of potential energy affect each other in a certain way. "All these centers of stress [*i. e.*, the various sensations] form an interconnected system each member of which inhibits or intensifies or in some way modifies all the others. In such a system there would naturally exist at each moment some one point at which the stress resulting from the intersecting energies which are proceeding from the various sensory centers was greater than any one of these energies. Such a point would constitute the ego-center of the perceptual field" (p. 380).

Here, again, Professor Montague speaks in terms of energy rather than of sensation. His procedure suggests a confusion between energy as identical with sensation, or some part of sensation, and energy as correlated with, or productive of, sensation. It is analogous to the confusion of the materialist between the propositions that mind is motion and that mind is the product of motion. If we are permitted to insist that the energy (plus quality) *is* sensation, the process just described must be statable in terms of sensation. This is particularly true since potential energy is something with the nature of which we are intimately acquainted only when it appears in sensation. To adopt the other procedure is to explain the known in terms of the unknown, or to reduce a familiar fact to a hazy and dubious construct. Now if our previous conclusion be correct, a sensation is composed of quality plus awareness. And since it would hardly be

maintained that the qualities are the components which operate as intersecting stresses, we seem compelled to assume that the ego-center is constituted as the result of the stress among various awarenesses. In other words, we are apparently confronted with a new form of the old problem how from various units or fragments to constitute the concrete unity of our conscious life. The experiential element that was cast out at the start has to be recovered in ways that are dark and vain. Hume, who, likewise, in his own peculiar way, made consciousness objective, invoked to no avail the magic of association to undo his ruthless work; and Kant, for the same reason, was obliged to seek a remedy beyond the uttermost bounds of space and time. If in the present instance we substitute sensation for potential energy, as we are told to do, a sudden transition from physics to mythology seems unavoidable. All our established conclusions as to the unity of consciousness are overthrown, and mind-stuffism is no longer *ein überwundener Standpunkt*.

We may now turn to the second general topic discussed by Professor Montague, viz., that of the relation between perceived quality and physical quality. Are we obliged to say that every quality belongs as perceived to the physical object, no matter how incompatible it may seem to be with the qualities revealed in other perceptions? This question presents two aspects. If it means to ask whether the presence or absence of an observer is a matter of indifference, the answer must be negative. "It is probable, for example, that the specific quality correlated with the ether wave-length that produces perceptual red, when the optic nerve current which it arouses is transformed into potential energy in the visual center, is itself something as different from red as the odor of musk" (p. 382).

But if, on the other hand, the point of the question be taken to lie in the comparison of the qualities with each other, the answer must be affirmative. The quality perceived is not to be contrasted with some other quality as appearance is contrasted with reality. The reason lies in the nature of the object. An object with its qualities is nothing but a mass or system of energies flowing in from other points. "A particular object, in other words, is nothing more nor less than the whole universe as it happens to focus itself or project itself on some particular point. Consequently our own perceptual activity when directed to an object contributes to the nature of that object just as truly, though, of course, not so largely, as the sun's shining upon it. The attributes which we ascribe to it do forthwith belong to it" (p. 382).

The difference between reality and appearance, as is further explained, is simply the difference between attributes which fit into a certain system and those which do not. As judged by this test,

some attributes are found to be *compossible* while others are not. "These *compossible* appearances are segregated from the general mass of appearance and contrasted with them as 'reality.' A mere appearance is simply a reality that has failed to harmonize with other realities, while, conversely, a reality is nothing but an appearance that has stood the test of our comparisons with other appearances. A thing as it is 'in itself' is a thing as it is for the whole universe of things collectively. It is the resultant of its appearances from all possible view-points" (p. 383).

In view of these considerations we are invited to take comfort in the reflection that our perceptual knowledge is "good and *real* so far as it goes." Caution, however, would suggest that acceptance of the invitation be postponed until we have ascertained how far this knowledge is likely to go. If a given object is "in itself" simply the resultant of its appearances from all possible view-points, then the judgment that it is "really" square signifies that squareness is the particular appearance which harmonizes or organizes all the divergent perceptions as to its shape. Since the other shapes are equally real, the preeminence of squareness simply indicates its "compossibility" with other shapes whereby we are enabled to fit objects together into a system.

Since, however, the apparent shapes of every object are literally innumerable, there seems to be no particular reason why different standards should not be employed by different persons or by the same person at different times. Why is it that we find so much agreement in practise as to the "real shape" of objects? Along the present lines we can reach but one conclusion. James would seem to have said the last word on the subject when he shows that the basis for our selection of the standard or real shape is practical convenience. The standard appearance is the one which is presented when vision reaches the highest degree of clearness and distinctness. "No other point of view offers so many esthetic and practical advantages. Here we believe we see the object as it *is;* elsewhere only as it seems."[2]

If this be the case, however, what is the precise meaning of the statement that "what the thing appears to me to be, in the full light of all my other knowledge, that it really is throughout the length and breadth of the world as known by me"? (p. 383). If it be true that the knowledge in question is simply a knowledge of practical requirements, as determined by the peculiarities of the *genus homo,* then the "resultant of its appearances from all possible view-points" tells me no more about the object as it is "in itself" than does any of its isolated appearances. And so far as knowing goes, apart from

[2] "Psychology," Vol. II., p. 239.

mere convenience, we seem to be forced back to the view that the nature of the object is indeterminate, that it can be all things to all men, that its appearance is its reality, and that truth and error is a meaningless distinction.

This conclusion may be reinforced by the consideration of another difficulty, or apparent difficulty, viz., as to the meaning of "possible view-points." If from a given view-point the object appears to an observer to have a certain quality, what happens to the object when the observer leaves his post and thereby reduces the latter to a mere "possible view-point"? Does nothing happen with respect to the qualities observed, *i. e.*, do the observers function merely as so many photographic plates to record what they find? Or is the presence of the observers a factor in determining the nature of the qualities which they observe?

Whichever alternative we adopt, we are at fault. If the presence of the observers is irrelevant to the possession by the object of the various qualities which it is seen to have, we seem to come into conflict with the argument according to which observed qualities are real precisely because the observers, since they constitute a part of the object's environment, contribute to the nature of that object. Moreover, the adoption of this alternative would simply emphasize our previous conclusion that the appearance of an object is its reality and that error is an impossibility. If, however, we resort to the second alternative and say that the multitude of qualities which this cloud of witnesses attests are in some way constituted by these witnesses themselves, then obviously the "appearance from all possible view-points" is a meaningless x, so long as the view-points remain mere possibilities. And however true our perceptual knowledge may be, it is true only while the perception endures.

In brief, we seem again compelled to choose between that interpretation which formed the basis for the original criticism and a Berkeleian metaphysics. The first of the alternatives just mentioned appears to be the one which Professor Montague's realism is intended to avoid. The second, however, involves an essential repetition of the performances of the earlier realism. We start with a world existing independently of experience, a world composed of energies and correlated qualities. Thence we pass to the world revealed in consciousness, a world translated for us into terms of potential energy. Once inside this latter world, however, we find that the entrance, like some gates to the platforms of elevated trains, admits only incoming travelers. All our categories, as we now find, are taken from this world of our perceptions. Or, to put it differently, the distinction between kinetic energy and potential energy is now found to be a distinction that falls wholly within the potential, *i. e.*,

kinetic as well as potential energy becomes known to us only when the stage of potential energy has been reached. That kinetic energy exists when this stage is not realized, or that its qualities are ascertainable by us, is an assumption for which the situation furnishes no warrant.

It is in no spirit of mere controversy, therefore, that I profess my inability to appreciate the cogency of Professor Montague's argument with respect to the criticisms against which it is directed. Whether these criticisms themselves possess any greater cogency is a different matter. Professor Montague may be quite right in his belief that the objections which they raise are not insuperable. At all events, his frank recognition that the time for constructive work has come may be taken as an indication that contemporary realism will give more attention to problems of this general sort than has hitherto been the case.

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REVIEWS AND ABSTRACTS OF LITERATURE

American Philosophy. The Early Schools. I. WOODBRIDGE RILEY. New York: Dodd, Mead & Co. Pp. ix + 584.

This is by far the most complete work which has yet appeared on the early history of philosophy in America. It is, in fact, the only one which attempts to treat the subject with thoroughness and in all its details. There is some literature, in the form of articles, on the general subject of philosophy in America or on its earlier representatives; there are chapters in histories of philosophy and of literature; some work on the earlier period has been presented in monograph form; and there is one small volume in French which reviews our philosophical development from the Colonial period to the present; but, on the whole, the field has been neglected by students of philosophy, so that this volume, although not quite a pioneer in the field, is the first to take full possession. The portion completely occupied is that which falls between 1620 and 1820. It is to be hoped that the volumes on the later periods will soon follow. Whatever value such study may have for philosophy itself, its historical interest can not be in doubt and its contribution to the better understanding of the national character should be considerable.

The author aims not merely at an account of men and schools, he wishes to show an organic relation among their doctrines and to indicate their relation to the larger aspects of national life. He meets the charge that America has slavishly borrowed her philosophies with the reply that she has exercised selection and has modified what she has borrowed to meet the demands of her own situation.

One of the earlier chapters traces a parallel between political and

philosophical developments. On the one hand, there is the change from the monarchical view of the time of the Stuarts, through limited monarchy, to democracy; and on the other, from the Puritan view of God as the absolute ruler of the universe, through deism, to a pantheistic view as embodied in transcendentalism. This parallelism, he holds, is not simply a coincidence, and he offers some evidence for his opinion—the general growth of naturalism and rationalism, for one thing. On the philosophical side he finds the beginning of this development in John Wise's "Vindication of the Government of the New England Churches," wherein theological arguments are supplemented by those based upon reason and natural rights. The chapter here under discussion is brief and suggests rather than proves a connection between the two developments.

After the introductory chapters, which include a historical survey of the whole course of development, the book falls into five parts, each dealing with a separate philosophical movement, as follows: "First, Puritanism as it sprang from English sources; second, deism, or free-thinking, as it began in reaction against a narrow Calvinism and ended with the revolutionary French skepticism; third, idealism as it arose spontaneously with Jonathan Edwards and was fostered by the Irish Bishop Berkeley, through his adherent Samuel Johnson; fourth, Anglo-French materialism, as it came over with Joseph Priestley and developed in Philadelphia and the South; fifth, realism, or the philosophy of common sense as it was imported directly from Scotland, and came to dominate the country until the advent of the German transcendentalism."

Book I., on Puritanism, contains a brief exposition of the philosophical principles of Puritanism and a presentation of anti-Puritanism as it was formulated by Ethan Allen in his "Oracles of Reason." The author protests against the tendency to emphasize the more picturesque and repellent features of Puritanism, and presents the philosophical tenets of its Calvinism as follows: in its ontology it teaches that the Deity is outside the framework of the universe, interferes from time to time according to an absolute and arbitrary will, works through inscrutable decrees and foreordains all things; in its cosmology it holds that the world is under the divine displeasure, that it conceals rather than reveals its creator, that it is created from nothing and that evil is a permissive act of God; in its epistemology, revelation rather than reason is regarded as the source of true knowledge, and God's will and nature are believed to be hidden in a mystery which man has no natural capacity to penetrate; in its theory of personality it teaches that God's essence is alien from that of man, that grace alone makes progress possible, that man's liberty works only within the limits of his foreordained nature, that the last dictate of the understanding determines the will, and yet that the inclinations are included within the will.

The reaction represented by Allen contends for reason as against revelation and inspiration, unvarying natural laws as against intervention, opposes the doctrines of original sin and imputation, and belittles

the dogma of predestination. Allen himself presents "an astonishing metaphysical scheme for one with scanty education and scantier authorities"; he reaches "an almost Spinozistic description of the universe," but there remain many inconsistent elements in his system and he is described as half deist, half pantheist. Dr. Riley has rendered an important service in giving to Allen his place in this development.

Proceeding from this point, he next considers idealism before showing the complete development of the deistic movement. Idealism in America in the eighteenth century can hardly be described as a movement since it is represented by only two men, Samuel Johnson and Jonathan Edwards. A tendency in that direction in the College of New Jersey came to an untimely end at the hand of John Witherspoon, and there seems to be no evidence of even a tendency elsewhere, with the exception of that at Yale College in the persons of the two men who were its chief exponents in this country.

The earlier of these was Samuel Johnson, the friend and disciple of Berkeley. His doctrines are fully and clearly presented, and further historical interest is added to the chapter by the inclusion of what remains of the correspondence between Berkeley and Johnson, as well as of extracts from Johnson's correspondence with Cadwallader Colden and from some of his sermons. A good proportion of this material is now published for the first time. Dr. Riley finds Johnson's most important contribution to philosophy in his reconciliation of Berkeley's immaterialism with Malebranche's vision of all things in God, and in the similar reconciliation of the doctrines of causality held by those philosophers.

In his chapter on Jonathan Edwards, Dr. Riley aligns himself with those who contend for Edwards's independence in the development of his idealistic theory, and he presents the evidence in brief and concise form. Aside from the exposition of Edwards's views, the thing of chief interest in the chapter is the attempt to show that the idealistic doctrines were the outgrowth of the mysticism which abounds in the philosopher's works and that the pantheistic tendencies, which were held in check by Calvinistic beliefs, were also organically related to this mysticism. Space does not permit a review of the arguments and the evidence, but the author seems to have made out a very good case. It is unfortunate that some of the Edwards literature has not been made accessible.

Following the discussion of idealism, we are taken back to the consideration of deism. Although this was not primarily a philosophical movement any more than was Puritanism, the complete understanding of the philosophical history of America demands that it should be included. The author uses the term, deism, very broadly. Rationalism, optimism, and opposition to Calvinism seem to be the characteristics which at first set it off from Puritanism. Such a Puritan as Cotton Mather presents both rationalistic and optimistic principles in his writings and is, therefore, selected as one of the forerunners of deism. The earliest representatives of the movement are to be found in the colleges and the more academic circles. At Harvard, Mather, Charles

Chauncy, Edward Holyoke, Andrew Eliot, Channing, and others entertained views which lead Dr. Riley to include them in the deistic movement, though most of them would doubtless be horrified to find into what company they have fallen. At Yale, Ezra Stiles had some sympathy for optimism and rationalism, but wished to fight English deism with its own weapon, reason. Of those connected with King's College, William Livingston and Samuel Johnson are related to the liberalizing movement. In the College of New Jersey these tendencies were strongly opposed, while in Philadelphia William Smith and his sponsor, Franklin, though going much farther than the New Englanders on the deistic road, were by no means extreme. Jefferson was less conservative, and in Thomas Paine the movement reached its height. Its popular influence was at its maximum in the early years of the nineteenth century. Volney, Elihu Palmer, and others carried on the propaganda, but a reaction had begun which soon became general, and deism rapidly declined.

The whole discussion of the deistic movement is exceedingly interesting and is an important contribution. The most interesting figures in its history are, of course, Franklin and Jefferson. The author presents a consistent and readable account of each.

In the section devoted to materialism, Cadwallader Colden is given the first place and the greatest amount of attention; he deserves it rather from the variety of his interests and the activity of his speculative faculties than from the completeness or consistency of his philosophy. With his materialistic doctrines, he is shown to have entertained tendencies toward pantheism as well as dualistic beliefs and a belief in the free-will doctrine; asserting the dynamic nature of matter, he still believed a prime mover necessary, and so on. In spite of his inconsistencies he is one of the most interesting figures in the whole book, and Dr. Riley's exposition is based principally upon material which has not before been exploited, most of it being unpublished. The next in order, Joseph Buchanan, of Kentucky, was somewhat more consistent. He aimed at a materialistic monism, held an epiphenomenalistic view of mind and was a determinist. Erasmus Darwin and Hartley were his philosophical ancestors. Joseph Priestley's views and their reception are briefly discussed and a short chapter is devoted to the dogmatic and belligerent Thomas Cooper, of South Carolina, materialist and determinist and anticipator of positivism (p. 419). The chapter on Benjamin Rush shows him as an utterly shameless eclectic. He shares with Buchanan the credit of making many interesting observations looking toward physiological psychology, and he makes many interesting suggestions in other parts of the psychological field, but these do not prove to be original. Among the half-dozen names in the chapter on "Minor Materialists," that of Sheldon Clark, of Connecticut, is the most important, but he, too, fails to present a consistent system. Materialism never became a popular philosophy, and it is surprising to find that even a scant dozen can be marshaled as its advocates. The next movement, on the other hand, is the one of all those discussed that obtained a popular verdict. Realism

from Witherspoon, through Stanhope Smith and Samuel Miller, to Beasley, and including Nisbet, Law, and Ogilvie, is the subject of Book V., which completes the volume. Including, as the author does, only the beginning of the nineteenth century, a good part of the literature of realism had to be omitted. This doubtless accounts for the comparative brevity with which the movement is presented.

Most readers will probably be surprised at the size of a volume which devotes itself exclusively to the early period. It is explained by the fact that we have before us the history of philosophical opinions rather than of philosophies; there was plenty of intellectual curiosity and no lack of speculation; and Dr. Riley has included whatever seems to throw light on the development of thought along philosophic lines. The fact that half the volume is devoted to deism and materialism might also be misleading at first. Deism was not primarily a philosophical movement and materialism was not general; but deism did, of course, have very important philosophical bearings, and the various representatives of materialism varied so much in their views and their ways of presenting them that the full treatment of them is justifiable. It is difficult, however, to clear the author of the charge of having cast his net perhaps over-widely in his search for deists and deism. All this, however, points to the merit of thoroughness. He will let no one escape. Dr. Riley has not deprived candidates for the doctorate of all opportunities for original work in the field; perhaps he has only multiplied them, but he has certainly worked the field very thoroughly himself. He has unearthed a quantity of new literature and he has produced a most excellent history. He can not expect entire agreement on minor points, but the verdict must be that he has done an exceedingly careful, thorough, and valuable piece of work.

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La fonction du sommeil. E. CLAPARÈDE. *Rivista di Scienza,* Vol. II., No. 3, 1907. Pp. 20.

In this article Claparède gives a brief account of his recently published theory of sleep and enumerates his criticisms of other theories. Previous theories may be classified into (*a*) circulatory, (*b*) neurodynamic, and (*c*) chemical, and the author takes up for consideration different theories in each of these general classes.

The circulatory theories are of two kinds: (1) those which explain the occurrence as due to cerebral anemia, and (2) those which report the occurrence of cerebral hyperemia. There are four types of the neurodynamic theory: (1) sleep is due to an interruption or decrease in the conductivity of the neurones; (2) it is not only due to a decrease in the conductivity, but there is a retraction of the nerve elements so that the different neurones are more widely separated than during the waking life; (3) there is in sleep an inhibition of the cerebral, and consequently of the intellectual, activity; and (4) sleep is due to the lack of excitation. The fourth type of this group is closely allied to the first. The chemical hypotheses that have been advanced to explain the conditions of sleep are

very varied. The principal ones of this class are: (1) that it is due to a periodic asphyxia of the cerebral substance, (2) that it is due to a decrease in the amount of food material or oxygen, (3) that there is an intoxication of the central nervous system by a periodic accumulation of waste products in the blood, and (4) that it is due to the specific action of a glandular (internal) secretion such as that from the hypophesis cerebri.

The author believes that none of these theories accounts for the condition, they do not explain it as a function, do not say whether it is active or passive and do not answer the "Why?". The circulatory and neurodynamic theories, in addition to having questionable bases of facts, do not show that the phenomena invoked to explain the condition are the cause rather than the effect. The chemical theories rest on the sophism, the author states, that when certain substances are introduced into the blood they produce sleep; it is true that they produce *a* sleep, but it is not certain that they produce *normal* sleep. These theories do not account for the cycle of waking and sleeping, nor do they explain in what manner and why sleep restores the organism. If weariness were the cause of sleep, sleep should always follow exertion and fatigue, but this is not the case. One can sleep without being weary and, on the other hand, one may be considerably wearied without being able to sleep, and at times there may be real insomnia. The influence of obscurity in producing sleep is not explained by any of the theories of the three groups mentioned above. The curve of the depth of sleep, determined by a number of investigators, is taken by Claparède as an indication that the sleep is not due to the action of some toxin or to the lack of food or oxygen, but is explained as having the character of the curve of work and fatigue. To the author the curve means that something is being tired, as if from use; "it is as if sleep were an activity which decreases little by little and that waking occurs after one is fatigued by sleeping"; which criticism and suggestion appear to the reviewer not only a wild guessing, but even mere word juggling. None of the theories accounts for the lack of sleep in some insane and none explains the morbid sleepiness in some hysterical states.

After clearing the ground the author begins to construct his own theory, which is called biological. He presents certain questions that appear to him should be answered by a good theory of sleep, and his answers constitute the biological theory which he has been developing during the past three or four years.

Is sleep an accident or a function? Nearly all the other theories consider sleep to be an accident, as a something that follows a condition of toxemia or asphyxia or as a cessation of activity, and at times as something almost abnormal. According to Claparède, however, sleep is not only the consequence or the reverse of waking, but is useful as such to the organism and is, therefore, a function. As sleep precedes exhaustion it prevents the latter, and thus is to be considered a function of defense of the body.

Is this function passive or active? In answering this question the

author compares sleep with the process of micturition, in which the expulsion of urine is not due to the opening of the sphincter because of the great pressure in the bladder, but is brought about long before the tone of the sphincter is overcome by the hydrostatic pressure. In a similar way, he says, sleep begins before the blood is charged with toxic substances sufficient to produce the condition. This function is, therefore, an active one, a biological instinct which has for its end that of arresting the functional activity of part of the body, not that the body may recover from the effects of intoxication, but that the body may not become intoxicated or poisoned.

What, then, is the mechanism of this reflex? Sleep can be produced by feelings of fatigue, by darkness, by lying down, by the sight of the place where one is accustomed to sleep, by the idea of sleep, etc., and it is probable that for normal sleep the action of these stimuli is increased by a certain amount of fatigue, and perhaps by a certain amount of blood change in the nature of poison or lack of food or oxygen. Whether or not there are certain cerebral areas or special nervous centers most involved in sleep, we do not know. Psychologically, sleep is a condition of disinterest for the presented situation or, in other words, it is a condition of total distraction. In sleep there is not an adaptation to what is going on, and "sleep consists in an inhibition of the reactivity." It is not sensibility that is enfeebled, but the ability to react. In sleep the inertia, the suppression of muscular work, prevents the too great use of bodily material and the production of deleterious products; but sleep is not solely a period of restoration after the diminishing muscular or bodily ability, for it is well known that repose—bodily immobility—does not restore as does sleep. The great restorative action of sleep is explained as due to a supposed reservation of energy (ordinarily used in nervous functions) for the needs of restoration, reassimilation, and nutrition of the organism.

This is the biological explanation of sleep. Sleep is not only a negative condition, it is not only for the purpose of getting rid of waste products, but is an active condition that enables the body to continue its work. In this sense the author is probably right. The explanation of the recuperative power of sleep is more than doubtful, for at present we know nothing of energy use by the cerebrum, and the explanation of transfer of cerebral energy to other, the vegetative, organs is nothing more than a guess. To the reviewer it appears probable that too much emphasis is placed on the value of sleep to the vegetative systems, and although one of the mistakes of the other hypotheses is the too exclusive consideration of the nervous system, it is likely that the greatest influence of sleep is on the nerve centers. The incessant activity of the nervous system during waking is followed by a period of comparative quiet during sleep, whereas we know that certain other systems of the body function just as well during the period of sleep. When we are awake the nervous system is used for the regulation and the activating of all the bodily mechanisms, and the vegetative systems, so far as we are aware,

are not so incessantly working. It is the nervous system that needs most rest, but it does not need all. In this connection, it would be interesting to compare in different kinds of animals the amount of sleep with the nervous development, and to determine any relation between the development and use of the higher nerve centers. Because of his artificial conditions of life man would need to be excluded from such a comparison or the lives of some of the domestic animals might be made to approach that of man. We also need more observations, such as were made by Patrick and Gilbert, on the amount of sleep needed for recovery after long periods of waking.

The biological theory of Claparède is an advance on the ones which he has criticized. The new theory will be elaborated and possibly changed to some extent, but even in its present condition it helps more than the older ones to a better understanding of the varied phenomena known as sleep.

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Das ästhetische Symbol. ROBERT M. WERNAER. *Zeitschrift für Philosophie und philosophische Kritik,* Band 130, Heft 1. April, 1907. Pp. 31.

The writer opens this interesting paper with the statement that an exhaustive treatment of the symbol is an *Ästhetik im Kleinen.* While expressly disavowing the writing of such an esthetic, he has nevertheless given us a suggestive glance into that new *Gefühls-ästhetik* which is rapidly breaking away from the older intellectualistic presuppositions. The symbol has always been the strong point of intellectualistic esthetics, for, despite the fact that we actually use the term symbolism to cover numerous *felt* meanings which can not be reduced to terms of the understanding, it is in general, as Wernaer says, only the artist and the artistically schooled that are conscious of any other than the intellectual symbol. Some of these felt meanings Wernaer has been able to isolate, and has made good his claim for the existence of a purely "esthetic symbol which is brought into being through feeling, and in which picture and affective content fuse into an unanalyzable unity." Thus in Millet's "Angelus," which is his chief illustration, we have, in addition to the picture for sense and the primary meaning which arises through the "feeling into" the picture of particular emotions, subjective and individual, *another* felt meaning, more objective and typical, "a meaning incorporated in the picture itself, and yet one which lies back of the particular experiences, and which is felt only as *Stimmung*—that this man and this woman express the relation of laboring humanity to God." In this case the secondary meaning is what we describe as religious, but it is only accidentally so. Symbolic art expresses many of the more general feelings which arise in the progress of the race.

With well-chosen illustrations from literature and art, he shows that

this symbol of the "second intention" is to be clearly distinguished from the intellectual symbol, which depends for its existence merely upon the fact that the ideal content is connected with the sensuous picture by some identity. In the affective symbol there can be no question of such a point of comparison, in Vischer's sense, for image and affective content are fused into one esthetic unity. Nor is it to be explained as arising out of a sense of "discrepancy" (in Hegel's sense) between picture and content, sense and thought, although there are some symbols of this logical-esthetic character. Neither of these logical explanations applies. The symbol in this case is purely psychological, and is psychologically, not logically, conditioned.

This analysis, with its negative conclusions, is well worked out, but such suggestions as Wernaer offers in the direction of the fuller characterization of these more objective moods and sentiments, with their purely affective meaning—as well as towards their explanation—are vague and disappointing. It is to be hoped that the present paper is to be but the prelude to more positive construction, and that in the working out of the suggestions already given the writer may be led to a consideration of the concepts of "affective generalization" and "affective logic," which have already proved useful in connection with the problem of esthetic symbolism, and to which some of his own analyses and descriptions already point.

WILBUR URBAN.

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JOURNALS AND NEW BOOKS

ZEITSCHRIFT FÜR PSYCHOLOGIE UND PHYSIOLOGIE DER SINNESORGANE. Bd. 46, Heft 4. *Zur Theorie der Gefühlstöne der Farbenempfindungen* (pp. 241–274): RICH. MÜLLER-FREIENFELS. – Two assumptions are made: that the Hering theory of color vision is true and that feeling tone is dependent upon the adequate functioning of the nervous mechanism. So far as color sensations themselves are agreeable, it is held that actual processes in the retina or cortex are directly responsible. The agreeableness of bright objects is thus traced to the activity of the white-black process. Saturation is treated as an exception, and agreeable only as meeting a desire for strong contrast or some other intellectual requirement. Further, it is claimed that the appreciation of rich colors is primitive and is being outgrown. Pleasing combinations, whether of complementaries or not, give rise to a balance of activities of different processes, or further the antagonistic processes in one substance. Small intervals do not form a combination, but a single impression. The brightest (ruddy) part of the spectrum is normally pleasing, but here, and always, associative factors and acquired prejudices must be considered. *Die angeblich falsche Wissentheorie der Psychologie. Ein Protest* (pp. 275–287): RICHARD HERBERTZ. – Three contentions of H. A. Prichard in an article in *Mind,* January, 1907, are examined

and criticized in turn. (1) "They (the psychologists) take their stand on a false theory of knowledge; (2) they ignore the unique character of the subject-object relation involved in knowledge; and (3) the desire for explanation which prompts their treatment is mistaken." It is argued that these contentions themselves rest upon a particular theory of knowledge; that the objects of consciousness (presented objects) are improperly identified with objects of knowledge proper, and these in turn with real objects. Psychology has a proper subject-matter, distinct from that of the other sciences and independent of any theory of knowledge, and not involving any particular doctrine of the relation of subject and object.

Literaturbericht.

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NOTES AND NEWS

To the Editors of the Journal of Philosophy, Psychology and Scientific Methods

Gentlemen: In your Journal of February 13 there appears a review of my first "Study in German Romanticism," in which my argument is so completely misstated that I request you to grant me space for the following correction:

The purpose of my study was not to show that "repetition of a word as a means of suspense" was "the contribution" of romanticism to the drama, but to examine the extent to which romantic emotionalism during a definitely limited historical period in German literature became (I quote from the last paragraph of my summary) "a fundamental part of the constructive conception of the modern drama."

Your reviewer quotes a number of scattered examples of repetition, to which I could have added a great many more, to show that repetition was used before German romanticism appeared, quite ignoring the fact that the first six pages of my study serve no other purpose except to show that *repetition is one of the fundamental structural elements of all forms of art.* I used repetition-of-a-word, at once a most *definite, easily perceived,* and—as I showed in the second part of the introduction—*fundamental* element of dramatic structure, merely as a technical means to subject the structural functions of romantic emotionalism to a more exact and fundamental test than has hitherto been done. Examples from other, non-romantic, writers, except those from Lessing and Schiller which were required for the historic-genetic reasons given in the study, would clearly have been irrelevant. *Your reviewer's criticism commits him to the assumption that I count Lessing and Schiller among the romanticists!*

I call Mr. Fletcher's attention to a review in the *Litterarische Centralblatt* of September 14, 1907, in which the subject and argument of my study are perfectly understood. Respectfully yours,

Martin Schütze.

University of Chicago,
February 21, 1908.

The third annual meeting of the Southern Society for Philosophy and Psychology was held in Washington, D. C., on February 26–27. President Roosevelt received the members of the Department of Superintendence and of the visiting societies at the White House on Wednesday afternoon, February 26, at 2:30. At the conclusion of the reception the following program was given by the Southern Society at University Hall, George Washington University: Psychic Effects of Anesthetics, Elmer E. Jones; The Pictorial Representation of Distance, Robert M. Ogden; An Experimental Study of the Efficiency and the Development of Memory in Children (by title), J. W. Baird; A Telepathic Experiment, Haywood J. Pearce; Universal Imperatives, J. F. Messenger; A Comparison of Spinoza's "Ethics" and Spencer's "First Principles," Edward H. Griffin; Inspiration from the Point of View of Psychology, George L. Raymond;

The Teleological Judgment, Edward E. Richardson. On Thursday morning, at University Hall, Professor W. D. Furry presented a paper on "The Esthetic Experience: Its Nature and Function in Epistemology." This was followed by the address of the President of the Society, and, later, by a discussion on "The Present Status of Logical Theory," introduced by Professor J. Mark Baldwin.

THE Western Philosophical Association met, conjointly with the American Psychological Association, at the University of Chicago, December 31, 1907, and January 1, 1908. The most notable parts of its program were a symposium on meaning and a symposium on value. The former will be printed in the *Psychological Review,* and the latter in this JOURNAL. A joint session was held with the American Psychological Association on the topic "The Relation of Ethics to Philosophy and Psychology." The officers for the year 1908 are as follows: President, Professor Arthur O. Lovejoy, Washington University; Vice-president, Professor George A. Coe, Northwestern University; Secretary-treasurer, Professor John E. Boodin, University of Kansas; new members of the Executive Committee, Professor F. C. Sharp, University of Wisconsin, and Professor G. A. Tawney, University of Illinois.

THE council of the senate of the University of Cambridge has recommended that the University hold a celebration in honor of Charles Darwin in 1909. Darwin was born on February 12, 1809, and the "Origin of Species" appeared in 1859. The year 1909 will, therefore, mark the hundredth anniversary of the first and the fiftieth anniversary of the second event. The week beginning June 20 appears to be the most convenient time for the celebration.

THE seventh meeting of the International Congress of Criminal Anthropology will open at Turin on April 28, under the presidency of Professor Lombroso. Communications relating to the congress should be addressed to the Secretariate of the Congress, Instituto di Medicina Legale, Via Michelangelo, 26, Turin, Italy.

PROFESSOR MAX MEYER, of the University of Missouri, and Professor Robert M. Ogden, of the University of Tennessee, had ready for publication last fall an English translation of the work by Adolf Hildebrand, "Das Problem der Form in der bildenden Kunst," to be published by G. E. Stechert & Co., New York. While being shipped from the printers to the publisher, the whole edition was lost by the railroad in a manner unknown. The book will be reprinted as soon as possible.

PROFESSOR E. HERSHEY SNEATH, who resigned his chair at Yale University two years ago owing to ill health, has accepted an appointment as lecturer on philosophy in the graduate school. Dr. Roswell P. Angier, instructor in psychology at Yale University, has been promoted to an assistant professorship of psychology.

PROFESSOR W. RIDGEWAY, professor of archeology in the University of Cambridge, has been elected president of the Royal Anthropological Institute.

DR. WM. A. HAMMOND has been appointed Sage professor of ancient philosophy in Cornell University.